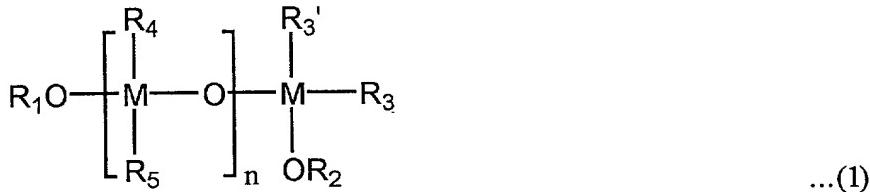


What is claimed is:

1. A protective layer composition comprising a metal compound of formula (1) below, a mercapto compound of formula (3) or (4) below, and a polar solvent:



5

where M is selected from the group consisting of Si, Ti, Sn, and Zr;

$R_1$  is a  $C_{1-20}$  alkyl group or  $-M(R_{14}R_{15}R_{16})$  where  $R_{14}$ ,  $R_{15}$ , and  $R_{16}$  are, independently, a  $C_{1-20}$  alkyl group, a  $C_{1-20}$  alkoxy group, or a  $C_6-C_{20}$  aryl group;

R<sub>2</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group;

at least one of  $R_3$  and  $R_3N$  is a  $C_1-C_{20}$  alkoxy group, and the remaining group is a  $C_1-C_{20}$  alkyl group, a  $C_1-C_{20}$  alkoxy group, a  $C_2-C_{20}$  alkylene group, or a  $C_6-C_{20}$  aryl group;

at least one of R<sub>4</sub> and R<sub>5</sub> is a C<sub>1</sub>-C<sub>20</sub> alkoxy group, and the remaining group is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group; and

*n* is an integer from 0 to 20,

where R<sub>9</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkyl group with a hydroxy group, a C<sub>1</sub>-C<sub>20</sub> hydroxyalkyl group with a hydroxy substituent, or -(CH<sub>2</sub>)<sub>k</sub>COOH, where k is an integer from 1 to 10, and



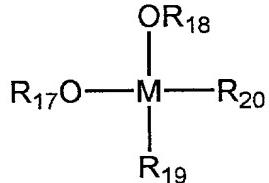
25

where R<sub>10</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group; R<sub>11</sub> and R<sub>12</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkoxy group, or a C<sub>1</sub>-C<sub>20</sub> alkyl group with a mercapto group; and R<sub>13</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group with a mercapto (-SH) group.

2. The protective layer composition of claim 1, wherein the mercapto compound of said formula (3) or (4) is at least one selected from the group consisting of 3-mercaptopropyltrimethoxysilane,  
5 3-mercaptopropylmethyldimethoxysilane, 3-mercato-1,2-propanediol, 1-mercato-2-propanol, 3-mercaptopropionic acid, di-(3-mercaptopropyl)dimethoxysilane, and tris-(3-mercaptopropyl)methoxysilane, and the mercapto compound is contained in an amount of 1-15 parts by weight based on 100 parts by weight of the metal compound of said formula (1).

10 3. The protective layer composition of claim 1, wherein the metal compound of said formula (1) is at least one selected from the group consisting of tetraethylorthosilicate, tetramethylorthosilicate, methyltrimethoxyorthosilicate, vinyltriethoxysilane, 3-glycidoxypolytrimethoxysilane, and phenyltriethoxysilane.

15 4. The protective layer composition of claim 1, further comprising a metal compound of formula (5) below:



... (5)

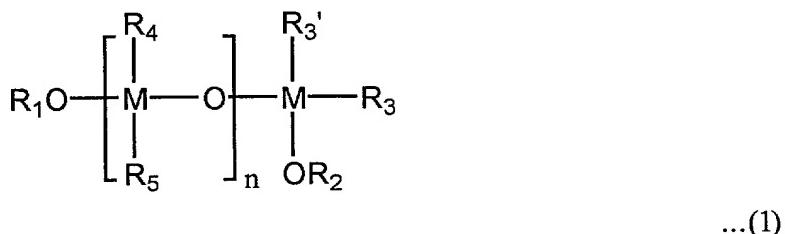
20 where M is selected from the group consisting of Si, Ti, Sn, and Zr; R<sub>17</sub> and R<sub>18</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group or a C<sub>6</sub>-C<sub>20</sub> aryl group; and  
25 R<sub>19</sub> and R<sub>20</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group.

30 5. The protective layer composition of claim 4, wherein the metal compound of said formula (5) is at least one selected from the group consisting of dimethyldimethoxyorthosilicate, diethyldimethoxyorthosilicate, dimethyldiethoxyorthosilicate, and diethyldiethoxyorthosilicate.

6. The protective layer composition of claim 1, wherein the polar solvent  
is at least one selected from the group consisting of ethanol, methanol, butanol,  
isopropanol, methylethylketone, methylcellosolve, and ethylcellosolve, and the polar  
solvent is contained in an amount of 1000-4000 parts by weight based on 100 parts  
5 by weight of the metal compound of said formula (1).

7. The protective layer composition of claim 1, further comprising a  
hydrolytic catalyst in an amount of 0.1-0.9 mole with respect to 1 mole of the metal  
compound of said formula (1), and the hydrolytic catalyst is at least one selected  
10 from the group consisting of nitric acid, hydrochloric acid, phosphoric acid, and  
sulfuric acid.

8. A spray-coated layer composition comprising a metal compound of  
formula (1) below, fluoroalkylsilane of formula (2) below, a mercapto compound of  
15 formula (3) or (4) below, and a polar solvent:  
15



where M is selected from the group consisting of Si, Ti, Sn, and Zr;

20 R<sub>1</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group or -M(R<sub>14</sub>R<sub>15</sub>R<sub>16</sub>) where R<sub>14</sub>, R<sub>15</sub>, and R<sub>16</sub> are,  
independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkoxy group, or a C<sub>6</sub>-C<sub>20</sub> aryl group;

R<sub>2</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group;

25 at least one of R<sub>3</sub> and R<sub>3</sub>N is a C<sub>1</sub>-C<sub>20</sub> alkoxy group, and the remaining group  
is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkoxy group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub>  
aryl group;

at least one of R<sub>4</sub> and R<sub>5</sub> is a C<sub>1</sub>-C<sub>20</sub> alkoxy group, and the remaining group is  
a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group; and

n is an integer from 0 to 20,



where  $R_5'$  is a fluorinated  $C_1-C_{20}$  alkyl group;  $R_6$  and  $R_7$  are, independently, a  $C_1-C_{20}$  alkoxy group or a fluorinated  $C_1-C_{20}$  alkyl group; and  $R_8$  is a  $C_1-C_{20}$  alkyl group,



where  $R_9$  is a  $C_1-C_{20}$  alkyl group, a  $C_1-C_{20}$  alkyl group with a hydroxy group, a  $C_1-C_{20}$  hydroxyalkyl group with a hydroxy substituent, or  $-(CH_2)_kCOOH$ , where  $k$  is an integer from 1 to 10, and



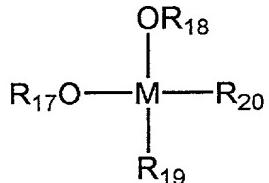
where  $R_{10}$  is a  $C_1-C_{20}$  alkyl group;  $R_{11}$  and  $R_{12}$  are, independently, a  $C_1-C_{20}$  alkyl group, a  $C_1-C_{20}$  alkoxy group, or a  $C_1-C_{20}$  alkyl group with a mercapto group; and  $R_{13}$  is a  $C_1-C_{20}$  alkyl group with a mercapto (-SH) group.

9. The spray-coated layer composition of claim 8, wherein the  
 fluoroalkylsilane of said formula (2) is at least one selected from the group consisting  
 of heptadecafluorodecyltriethoxysilane, pentadecafluorohexyltrimethoxysilane,  
 heptadecafluorodecyltrimethoxysilane, heptadecafluorodecyltrisopropoxysilane,  
 heptadecafluorodecyltributoxysilane, di-(heptadecafluorodecyl)diethoxysilane, and  
 tris-(heptadecafluorodecyl)ethoxysilane, and the fluoroalkylsilane of said formula (2) is  
 contained in an amount of 1-15 parts by weight based on 100 parts by weight of the  
 metal compound of formula (1).

10. The spray-coated layer composition of claim 8, wherein the mercapto compound of said formula (3) or (4) is at least one selected from the group consisting of 3-mercaptopropyltrimethoxysilane,  
3-mercaptopropylmethyldimethoxysilane, 3-mercato-1,2-propanediol,  
5 1-mecapto-2-propanol, 3-mercaptopropionic acid,  
di-(3-mercaptopropyl)dimethoxysilane, and tris-(3-mercaptopropyl)methoxysilane,  
and the mercapto compound is contained in an amount of 1-15 parts by weight  
based on 100 parts by weight of the metal compound of said formula (1).

10 11. The spray-coated layer composition of claim 8, wherein the metal compound of said formula (1) is at least one selected from the group consisting of tetraethylorthosilicate, tetramethylorthosilicate, methyltrimethoxyorthosilicate,  
15 vinyltriethoxysilane, 3-glycidoxypolytrimethoxysilane, and phenyltriethoxysilane.

12. The spay coated layer composition of claim 8, further comprising a metal compound of formula (5) below:



... (5)

20 where M is selected from the group consisting of Si, Ti, Sn, and Zr;  
R<sub>17</sub> and R<sub>18</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group or a C<sub>6</sub>-C<sub>20</sub> aryl group;  
and  
R<sub>19</sub> and R<sub>20</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group,  
or a C<sub>6</sub>-C<sub>20</sub> aryl group.

25 13. The spray-coated layer composition of claim 12, wherein the metal compound of said formula (5) is at least one selected from the group consisting of dimethyldimethoxyorthosilicate, diethyldimethoxyorthosilicate,  
dimethylethoxyorthosilicate, and diethyldiethoxyorthosilicate.

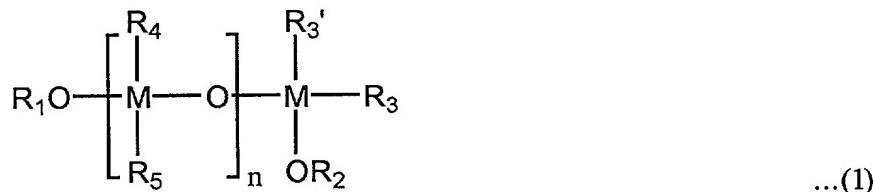
14. The spray-coated layer composition of claim 8, wherein the polar solvent is at least one selected from the group consisting of ethanol, methanol, butanol, isopropanol, methylethylketone, methylcellosolve, and ethylcellosolve, and the polar solvent is contained in an amount of 1000-4000 parts by weight based on  
5 100 parts by weight of the metal compound of said formula (1).

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15. The spray-coated layer composition of claim 9, further comprising a hydrolytic catalyst in an amount of 0.1-0.9 mole with respect to 1 mole of the metal compound of said formula (1), and the hydrolytic catalyst is at least one selected from the group consisting of nitric acid, hydrochloric acid, phosphoric acid, and sulfuric acid.

16. A transparent conductive layer comprising a conductive layer containing a metal oxide and a protective layer formed on the conductive layer, the protective layer containing a hydrolyzed and polycondensated product of a metal compound of formula (1) below and at least one of a mercapto compound of formula (3) or (4) below and its hydrolyzed and polycondensated product:

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where M is selected from the group consisting of Si, Ti, Sn, and Zr;

$R_1$  is a  $C_{1-20}$  alkyl group or  $-M(R_{14}R_{15}R_{16})$  where  $R_{14}$ ,  $R_{15}$ , and  $R_{16}$  are, independently, a  $C_{1-20}$  alkyl group, a  $C_{1-20}$  alkoxy group, or a  $C_6-C_{20}$  aryl group;

R<sub>2</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group;

25

at least one of  $R_3$  and  $R_3N$  is a  $C_1-C_{20}$  alkoxy group, and the remaining group is a  $C_1-C_{20}$  alkyl group, a  $C_1-C_{20}$  alkoxy group, a  $C_2-C_{20}$  alkylene group, or a  $C_6-C_{20}$  aryl group;

at least one of R<sub>4</sub> and R<sub>5</sub> is a C<sub>1</sub>-C<sub>20</sub> alkoxy group, and the remaining group is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group; and

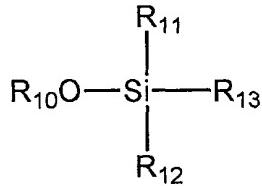
30

R<sub>9</sub> SH

...(3)

where R<sub>9</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkyl group with a hydroxy group, a C<sub>1</sub>-C<sub>20</sub> hydroxyalkyl group with a hydroxy substituent, or -(CH<sub>2</sub>)<sub>k</sub>COOH, where k is an

5 integer from 1 to 10, and



...(4)

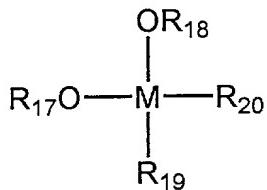
where R<sub>10</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group; R<sub>11</sub> and R<sub>12</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkoxy group, or a C<sub>1</sub>-C<sub>20</sub> alkyl group with a mercapto group; and R<sub>13</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group with a mercapto (-SH) group.

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17. The transparent conductive layer of claim 16, wherein the mercapto compound of said formula (3) or (4) is at least one selected from the group consisting of 3-mercaptopropyltrimethoxysilane, 3-mercaptopropylmethyldimethoxysilane, 3-mercato-1,2-propanediol, 1-mercato-2-propanol, 3-mercaptopropionic acid, di-(3-mercaptopropyl)dimethoxysilane, and tris-(3-mercaptopropyl)methoxysilane, and the mercapto compound is contained in an amount of 1-15 parts by weight based on 100 parts by weight of the metal compound of said formula (1).

18. The transparent conductive layer of claim 16, wherein the metal compound of said formula (1) is at least one selected from the group consisting of tetraethylorthosilicate, tetramethylorthosilicate, methyltrimethoxyorthosilicate, vinyltriethoxysilane, 3-glycidoxypoly(trimethoxysilane), and phenyltriethoxysilane.

25  
19. The transparent conductive layer of claim 16, wherein the protective layer further contains a hydrolyzed and polycondensated product of a metal compound of formula (5) below:



...(5)

where M is selected from the group consisting of Si, Ti, Sn, and Zr;

5 R<sub>17</sub> and R<sub>18</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group or a C<sub>6</sub>-C<sub>20</sub> aryl group;

and

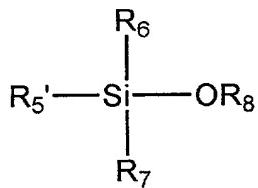
R<sub>19</sub> and R<sub>20</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group.

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20. The transparent conductive layer of claim 19, wherein the metal compound of said formula (5) is at least one selected from the group consisting of dimethyldimethoxyorthosilicate, diethyldimethoxyorthosilicate, dimethyldiethoxyorthosilicate, and diethyldiethoxyorthosilicate.

20

21. The transparent conductive layer of claim 16, further comprising, on the protective layer, a spray-coated layer containing a hydrolyzed and polycondensated product of the metal compound of said formula (1), at least one of fluoroalkylsilane of formula (2) below and its hydrolyzed and polycondensated product, and at least one of a mercapto compound of said formula (3) or (4) and its hydrolyzed and polycondensated product:



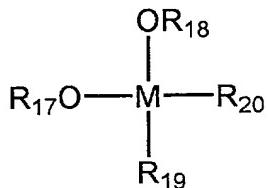
...(2)

25

where R<sub>5</sub>' is a fluorinated C<sub>1</sub>-C<sub>20</sub> alkyl group; R<sub>6</sub> and R<sub>7</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkoxy group or a fluorinated C<sub>1</sub>-C<sub>20</sub> alkyl group; and R<sub>8</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group.

22. The transparent conductive layer of claim 21, wherein the spray-coated layer is formed as a non-continuous layer.

23. The transparent conductive layer of claim 21, wherein the spray-coated layer further contains a hydrolyzed and polycondensated product of a metal compound of formula (5) below:



... (5)

where M is selected from the group consisting of Si, Ti, Sn, and Zr;

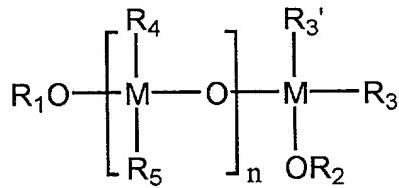
R<sub>17</sub> and R<sub>18</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group or a C<sub>6</sub>-C<sub>20</sub> aryl group;

and

R<sub>19</sub> and R<sub>20</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group.

24. A transparent conductive layer comprising a conductive layer containing a metal oxide and a protective layer and spray-coated layer sequentially formed to protect the conductive layer, the spray-coated layer containing a hydrolyzed and polycondensated product of a metal compound of formula (1) below, at least one of fluoroalkylsilane of formula (2) below and its hydrolyzed and polycondensated product, and at least one of a mercapto compound of formula (3) or (4) below and its hydrolyzed and polycondensated product, and the protective layer containing a hydrolyzed and polycondensated product of the metal compound of said formula (1):

25



... (1)

where M is selected from the group consisting of Si, Ti, Sn, and Zr;

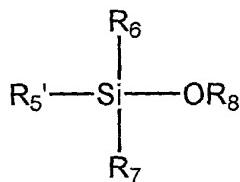
R<sub>1</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group or -M(R<sub>14</sub>R<sub>15</sub>R<sub>16</sub>) where R<sub>14</sub>, R<sub>15</sub>, and R<sub>16</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkoxy group, or a C<sub>6</sub>-C<sub>20</sub> aryl group;

R<sub>2</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group;

at least one of R<sub>3</sub> and R<sub>3</sub>N is a C<sub>1</sub>-C<sub>20</sub> alkoxy group, and the remaining group is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkoxy group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group;

5 at least one of R<sub>4</sub> and R<sub>5</sub> is a C<sub>1</sub>-C<sub>20</sub> alkoxy group, and the remaining group is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, or a C<sub>6</sub>-C<sub>20</sub> aryl group; and

n is an integer from 0 to 20,

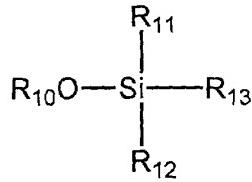


10 ... (2)

where R<sub>5</sub>N is a fluorinated C<sub>1</sub>-C<sub>20</sub> alkyl group; R<sub>6</sub> and R<sub>7</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkoxy group or a fluorinated C<sub>1</sub>-C<sub>20</sub> alkyl group; and R<sub>8</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group,



15 where R<sub>9</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkyl group with a hydroxy group, a C<sub>1</sub>-C<sub>20</sub> hydroxyalkyl group with a hydroxy substituent, or -(CH<sub>2</sub>)<sub>k</sub>COOH, where k is an integer from 1 to 10, and



20 ... (4)

where R<sub>10</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group; R<sub>11</sub> and R<sub>12</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>1</sub>-C<sub>20</sub> alkoxy group, or a C<sub>1</sub>-C<sub>20</sub> alkyl group with a mercapto group; and R<sub>13</sub> is a C<sub>1</sub>-C<sub>20</sub> alkyl group with a mercapto (-SH) group.

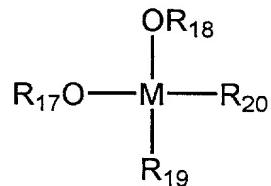
25. The transparent conductive layer of claim 24, wherein the spray-coated layer is formed as a non-continuous layer.

26. The transparent conductive layer of claim 24, wherein the  
5 fluoroalkylsilane of said formula (2) is at least one selected from the group consisting of heptadecafluorodecyltriethoxysilane, pentadecafluorohexyltrimethoxysilane, heptadecafluorodecyltrimethoxysilane, heptadecafluorodecyltriisopropoxysilane, heptadecafluorodecyltributoxysilane, di-(heptadecafluorodecyl)diethoxysilane, and tris-(heptadecafluorodecyl)ethoxysilane, and the fluoroalkylsilane of said formula (2) is  
10 contained in an amount of 1-15 parts by weight based on 100 parts by weight of the metal compound of formula (1).

27. The transparent conductive layer of claim 24, wherein the mercapto compound of said formula (3) or (4) is at least one selected from the group consisting of 3-mercaptopropyltrimethoxysilane, 3-mercaptopropylmethyldimethoxysilane, 3-mercato-1,2-propanediol, 1-mercato-2-propanol, 3-mercaptopropionic acid, di-(3-mercaptopropyl)dimethoxysilane, and tris-(3-mercaptopropyl)methoxysilane, and the mercapto compound is contained in an amount of 1-15 parts by weight based on 100 parts by weight of the metal compound of said formula (1).

28. The transparent conductive layer of claim 24, wherein the metal compound of said formula (1) is at least one selected from the group consisting of tetraethylorthosilicate, tetramethylorthosilicate, methyltrimethoxyorthosilicate,  
25 3-glycidoxypolytrimethoxysilane, vinyltriethoxysilane, and phenyltriethoxysilane.

29. The transparent conductive layer of claim 24, wherein the spray-coated layer further contains a hydrolyzed and polycondensated product of a metal compound of formula (5) below:



30 ... (5)

where M is selected from the group consisting of Si, Ti, Sn, and Zr;

R<sub>17</sub> and R<sub>18</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group or a C<sub>6</sub>-C<sub>20</sub> aryl group; and

R<sub>19</sub> and R<sub>20</sub> are, independently, a C<sub>1</sub>-C<sub>20</sub> alkyl group, a C<sub>2</sub>-C<sub>20</sub> alkylene group, 5 or a C<sub>6</sub>-C<sub>20</sub> aryl group.

30. The transparent conductive layer of claim 29, wherein the metal compound of said formula (5) is at least one selected from the group consisting of dimethyldimethoxyorthosilicate, diethyldimethoxyorthosilicate, 10 dimethylethoxyorthosilicate, and diethylmethoxyorthosilicate.

31. An image display device employing the transparent conductive layer of claim 16.

32. The image display device of claim 31, wherein the transparent conductive layer is formed on a panel of a cathode ray tube.

33. An image display device employing the transparent conductive layer of claim 24.

34. The image display device of claim 33, wherein the transparent conductive layer is formed on a panel of a cathode ray tube.